Remarks

In these amendments, the claims have been amended to specify chromatic dispersion, and in claim 44 to specify using a magnitude of the detected power. There is support throughout the application as filed for the dispersion being chromatic dispersion, starting with the introduction on page 1. There is support for specifying the magnitude of the detected power since that is inherent in the operation of the RF detectors 84 of figure 8. Hence there is no question of adding new matter.

Regarding item 3, the Examiner rejects various of the claims under 35 U.S.C. §102 for anticipation by Ibukuro. Reconsideration is requested.

Re claims 44-45 and 57, Ibukuro teaches an alternative method of measuring dispersion. In the system of Ibukuro, a low frequency oscillation, FM is superimposed upon a non-data carrying signal at the transmitter (23). In the receiver, light from a local oscillator laser, which is offset in frequency from the transmit laser by Δf, is combined with the data signal (25). The heterodyne detection of the two lasers generates an RF signal of frequency □f, which has sideband components at □f-fm and □f+fm. These two components are individually filtered out. The dispersion is evaluated by performing a phase comparison of the two frequencies. The system of Ibukuro cannot work on the channel which is carrying a data modulated signal, because the modulation of the data would disrupt the phase comparison needed for measuring the dispersion.

The main differences between Ibukuro and the present independent method claim 44 are:

1) Ibukuro does not operate on the data carrying signal, he instead uses tones on an unused wavelength channel.

2) Ibukuro uses a phase comparison not a magnitude of RF power in narrow frequency bands.

Accordingly the claim is not anticipated. Regarding non-obviousness, these distinctions are significant because the measurement can be carried out while there

is data being transmitted. This can be important to maximize transmission capacity and therefore revenue, or to ensure the measurement is carried out under realistic operating conditions. Furthermore the method as claimed can reduce complexity and costs, since there is no need for the features needed by the prior art of a) low frequency modulation, b) a local oscillator laser, and c) phase comparison. There is no suggestion in this prior art or any other, of these advantages nor how to achieve them. Therefore the claim involves an inventive step and the subject mater would not have been obvious.

Apparatus claim 57 has corresponding distinctive features, and since all the other claims are dependent, all the claims are allowable for the same reasons.

<u>Other prior art</u>

Noe et al. and Ooi et al. are cited against dependent claims 46 and 59. Both references describe methods of compensating for Polarisation Mode Dispersion (PMD) as distinct from Chromatic Dispersion (CD). PMD is a very different impairment from CD and as such the mechanisms which cause power at different RF spectral components to fluctuate are different: PMD is an effect whereby one principal state of polarisation is delayed with respect from the other principal state. When these two components are detected on a photodiode, the electrical signals are superimposed upon one another, which results in two copies of the signal being superimposed upon one another, one being delayed with respect to the other. The magnitude of the delay and the proportion of power between the components fluctuates with time.

The mechanism of Chromatic Dispersion is very different from PMD. Here the distortion occurs because each individual pulse actually comprises a number of frequency components. The dispersion means that different frequency components propagate at different speeds, so the pulses broaden with distance along the fiber. Eventually one pulse will broaden into its neighbor and cause inter symbol interference. The actual mechanism for CD detection is more subtle however and needs to be considered in the frequency domain. Here each frequency component above the carrier frequency has a corresponding frequency component below the carrier frequency. The effect of dispersion is to introduce a phase-shift between each

pair. When the pair are out of phase, the signal is nulled completely. At in-between values there is a reduction in RF power.

Noe teaches the use of monitoring 3 RF frequencies. However, this is in conjunction with a PMD compensator, not an adjustable Chromatic Dispersion Compensator. As discussed above the mechanism for detecting CD is completely different from that of PMD.

Ooi teaches the rational for choosing the frequencies to monitor PMD. This is shown in *Figure* 13. Significant differences can be seen in comparison with the corresponding figure 9 in the present application. Firstly, the parameter on the x-axis of Ooi et al. is Differential Delay, measured in ps. The parameter on the x-axis in the present application is Dispersion, measured in ps/nm. Note also that in Ooi, the 0.5x bit rate signal is at a maximum, when the 0.25xbit rate signal is at a minimum. In this application, the halfxbit rate signal is a maximum when the 1/sqrt(2) signal is at a minimum.

Ooi describes a method of compensating for PMD by splitting the signal into two components and delaying one component with respect to the other and recombining them. This is concerned with dithering the differential delay in ps between the two arms.

In the present application, a different parameter is dithered. The amount of chromatic dispersion in ps/nm is dithered. This is dithered by directly applying a signal to an adjustable dispersion compensator.

Bulmer is cited against dependent claim 56 as showing a lock in amplifier. There is no disclosure or suggestion of the distinctive features discussed above, so this reference is not relevant to the independent claims.

For these reasons Noe, Bulmer and Ooi are not relevant to the present claims either alone or in combination with other references.

<u>Other matters</u>

Claim 47 has been amended to make it clearer that the optical filter is designed to have a narrow bandwidth which is less than the bandwidth of the data modulated

signal. This can enable it to remove parts of the data spectrum which cause an erroneous signal to be obtained. In this case, if an RF modulation format is used then large frequency components appear either side of the carrier, separated in frequency by the magnitude of the clock frequency.

Non-elected claims 1 - 43 and 68 - 70 have been cancelled.

All the points raised by the Examiner have now been met and favorable reconsideration is requested.

October 28, 2003

Respectfully submitted,

William M. Lee, Jr.
Registration No. 26,935
Barnes & Thornburg
P.O. Box 2786
Chicago, Illinois 60690-2786
(312) 214-4800
(312) 759-5646 (fax)